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(12) United States Patent
Saruta**(10) Patent No.: US 6,196,670 B1****(45) Date of Patent: Mar. 6, 2001****(54) PRINTER AND INK CARTRIDGE**
ATTACHED THERETO**(75) Inventor:** Toshihisa Saruta, Nagano-ken (JP)**(73) Assignee:** Seiko Epson Corporation, Tokyo (JP)**(*) Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.**(21) Appl. No.:** 09/449,731**(22) Filed:** Nov. 26, 1999**(30) Foreign Application Priority Data**

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(51) Int. Cl.⁷ B41J 2/175**(52) U.S. Cl.** 347/86**(58) Field of Search** 347/84, 85, 86,
347/87, 5, 14, 29, 33, 34, 7; 395/112**(56) References Cited****U.S. PATENT DOCUMENTS**

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A printer that enables required data, such as a remaining quantity of each ink, to be written securely even when a storage device having a relatively low allowable frequency of rewriting is applied for a storage element mounted on an ink cartridge. An ink cartridge that is detachably attached to the printer. In the printer, a sequential access-type EEPROM having a relatively low allowable frequency of rewriting is applied for storage elements incorporated in both a black ink cartridge and a color ink cartridge. A print controller in the printer has a memory, for which an EEPROM (or a DRAM) is applicable. Data relating to each ink cartridge, such as a remaining quantity of each ink in the ink cartridge, are stored into both the EEPROM of the print controller and a memory cell included in the storage element of the ink cartridge. The writing operation of data into the EEPROM of the print controller is carried out at every time the remaining quantity of each ink is calculated, whereas the writing operation into the memory cell in the storage element of the ink cartridge is carried out restrictedly in response to a power down instruction. This arrangement causes the frequency of writing into the storage element of the ink cartridge to be lower than the frequency of writing into the EEPROM of the print controller. This accordingly fulfills the requirements, that is, the sufficient reliability of data and the restriction of the allowable frequency of rewriting.

30 Claims, 16 Drawing Sheets